

What is claimed is:

1. A method of detecting a biological analyte within a sample, wherein said analyte can be electrically charged or polarized in the presence of an electric field, said method comprising:

placing said sample in proximity with a ferroelectric transducer;
establishing an electric field to polarize said analyte in said sample;
sensing an electric response of said ferroelectric transducer resulting from said electric field and indicative of the presence of said analyte in said sample.
2. The method of claim 1, further comprising determining a signal difference between said electric response and a reference signal, said signal difference indicative of the presence of said analyte.
3. The method of claim 2, wherein said signal difference is indicative of the concentration or density of said analyte.
4. The method of any one of claims 1 to 3, comprising disposing said transducer and said sample between first and second electrodes, and applying a voltage to said first and second electrodes to establish said electric field in said sample.
5. The method of claim 4 wherein said first electrode is in contact with said transducer and a second electrode is in contact with said sample.
6. The method of claim 4 or claim 5 wherein said electric response is said voltage when a pre-selected electric current is flowing between said electrodes.
7. The method of claim 4 or claim 5 wherein said electric response is the electric current flowing through said electrodes when said voltage has a pre-selected value.
8. The method of any one of claims 1 to 7, wherein said ferroelectric transducer comprises one or more of $\text{Ba}_x\text{Sr}_{1-x}\text{TiO}_3$ (BST), $\text{Pb}(\text{Zr}_x\text{Ti}_{1-x})\text{O}_3$ (PZT) and ferroelectric polymers, wherein x is between 0 and 1.

9. The method of any one of claims 1 to 8 wherein said transducer is a thin film.
10. The method of any one of claims 1 to 9 wherein said analyte is one of protein, DNA, virus, antigen-antibody, bacteria, fungus, and drug.
11. The method of any one of claims 1 to 10, wherein said placing comprises immobilizing said analyte in said sample on said transducer.
12. The method of claim 11, wherein said analyte is immobilized directly on a ferroelectric layer of said transducer.
13. The method of claim 11, wherein said immobilizing comprises binding said analyte to a probe molecule attached to said transducer, said probe molecule having specific affinity to said analyte.
14. The method of claim 12, further comprising, after immobilizing said analyte on said transducer and before said sensing, removing a remaining portion of said sample and attaching a probe molecule to said analyte, said probe molecule having specific affinity to said analyte, and wherein said electric response is indicative of the presence of said probe molecule and thus said analyte.
15. A sensor for detecting a biological analyte within a sample, wherein said analyte can be electrically charged or polarized in an electric field, said sensor comprising:
 - a ferroelectric transducer;
 - a biological sample disposed adjacent said transducer;
 - first and second electrodes for establishing a potential difference across said sample to generate an electric field in said sample; and
 - an electric signal detector for sensing an electric response of said ferroelectric transducer resulting from polarization of said analyte, and indicative of the presence of said analyte in said sample.
16. The sensor of claim 15 further comprising a source connected to one or more of said first and second electrodes for applying a voltage to said first and second electrodes.

17. The sensor of claim 15 or claim 16, wherein said ferroelectric transducer comprises one or more of $\text{Ba}_x\text{Sr}_{1-x}\text{TiO}_3$ (BST), $\text{Pb}(\text{Zr}_x\text{Ti}_{1-x})\text{O}_3$ (PZT) and ferroelectric polymers, wherein x is between 0 and 1.
18. The sensor of any one of claims 15 to 17 wherein said transducer is a thin film.
19. The sensor of any one of claims 15 to 18 wherein said analyte is one of protein, DNA, virus, antigen-antibody, bacteria, fungus, and drug.
20. The sensor of any one of claims 15 to 19, wherein said first electrode is in contact with said transducer and said second electrode is in contact with said sample.
21. The sensor of any one of claims 15 to 20 wherein said transducer is in contact with said sample.
22. The sensor of any one of claims 15 to 21 wherein said analyte in said sample is immobilized on said transducer.
23. The sensor of claim 22, wherein said analyte is directly attached to said transducer.
24. The sensor of claim 22, further comprising a probe molecule attached to said transducer, said probe molecule having specific affinity to said analyte, said analyte being bond to said probe molecule.